NAI Focus Group

NASA ASTROBIOLOGY INSTITUTE

NASA Astrobiology Institute Introduction

NAI is a "virtual collaboratory" distributed across the United States and bound together through advanced telecommunications and electronic networking. The institute represents a partnership between NASA, universities, and research organizations to promote conduct, and lead integrated multidisciplinary research, to train young scientists, and to provide public access to the adventure of studying the living universe.

Focus Groups Introduction

Focus Groups are research and planning teams formed around topics relevant to specific NAI goals and objectives. Established based on proposals submitted to NAI, Focus Groups contribute to astrobiology space missions and extend long-distance collaborations through the innovative use of networking and other technologies.

Europa Focus Group

"How did life begin?" and "What is the future of life in the Universe? encompass the subject matter of astrobiology. Jupiter's moon Europa may be one in a group of planets and moons that may have the potential for supporting life. In September 2000, the Europa Focus Group was established as a forum to exchange information and share ideas regarding this intriguing satellite.

Is There Life under the Ice?

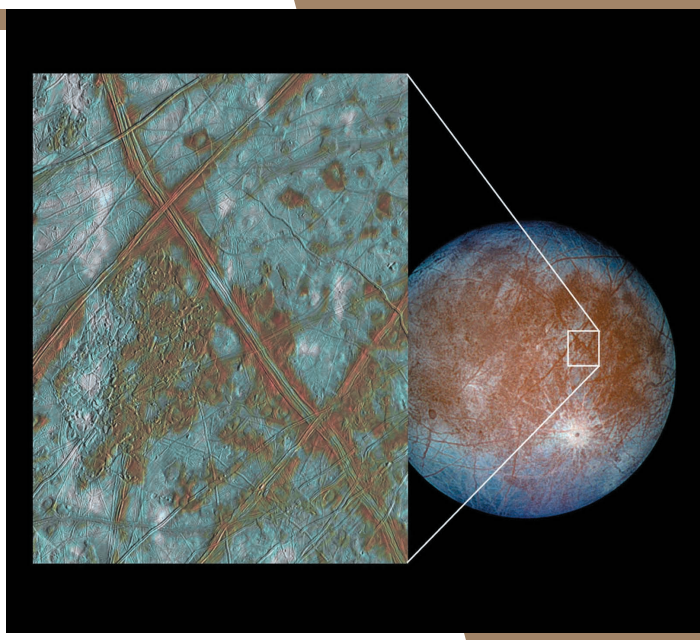
Europa is a cold, rocky object slightly smaller than Earth's moon. Under its icy surface Europa is suspected to contain an ocean of water. This is what makes the moon so interesting from a scientific standpoint and what gives it the potential for supporting life. The presence of liquid water alone is not sufficient for the development or support of life. However, there are indications that Europa may also possess an energy source required to drive biological activity and the biogenic elements that are also required to support life.

The massive gravitational pull of Jupiter, and that of its other moons, may generate enough heat through tidal forces to fuel volcanic activity on the ocean floor of Europa. If this is the case, it may be an indication of thermal vents. On Earth, these vents present particularly harsh environments. Located in the darkness, cold, and extreme pressures of the deep ocean floor, thermal vents expel a mix of water and toxic chemicals approaching 400°C. Surprisingly, certain anaerobic organisms such as bacteria and archaeans (the first cells that Eubacteria and Eukaryotes derived from) thrive here on the heat and chemicals provided by thermal vents and could possibly do so on Europa. We also know, through remote sensing, that salts are present on Europa's surface. It is likely that comet impacts have deposited these organic compounds fundamental to the chemistry of life.

Taken together, these factors suggest that Europa may have the essential ingredients necessary for

"The Surface of Europa" The moon Europa has attracted increased interest as evidence mounts that a liquid ocean may lie beneath the frozen crust.

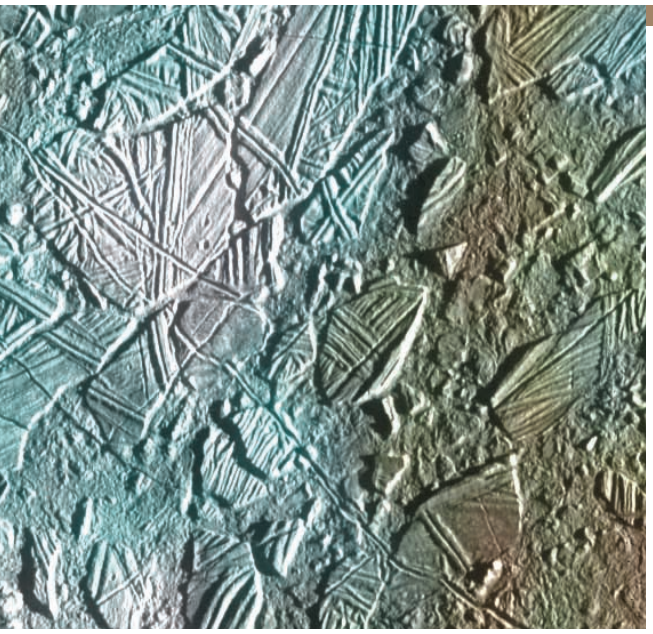
life to exist. As a result, NASA and the National Academy of Sciences have identified Europa as a high priority for exploration. NASA has defined a Europa Orbiter mission with a projected launch date of November 2003. This mission's primary objectives are to determine whether an ocean does exist beneath the surface, characterize the three-dimensional distribution of the ice crust and any liquid layers below, understand the formation of surface features, and identify possible landing sites for future missions to Europa's surface.



"The Landscape and Features on Europa" This image from the Galileo spacecraft shows the surface features on Jupiter's icy moon.

Focus Group Activities

The NAI Europa Focus Group, chaired by Dr. Ronald Greeley of the Department of Geological Sciences at Arizona State University, conducts a variety of activities to extend our Europan knowledge base. The group is both international and multidisciplinary, consisting of planetary scientists, sea ice experts, chemists, and biologists familiar with ice-rich environments. Through video conferences and workshops, they investigate Europan exobiologic environments and strategies for detecting any life that might exist there. They also assess regions of Europa where liquid and ice interface—in particular, cracks in the ice crust that may allow liquid water and any possible organisms to reach the surface. Much of the group's analysis of Europa is based on images and other data transmitted to Earth by the Galileo space probe.



"Blocks in the Europan Crust Provide More Evidence of Subterranean Ocean" This image shows a region of Europa's crust made up of blocks which are thought to have broken apart and "rafted" into new positions.

Finally, the Focus Group evaluates environments here on Earth that may be analogous to those found on Europa. Potential analogs include sea ice, land ice, ocean-floor volcanism, and the glacier-covered Lake Vostock in Antarctica. While these represent some of the most extreme and inhospitable settings on Earth, they are places we know life can not only exist but also thrive. Those settings deemed appropriate could be used as models to field test theories, techniques, and equipment before going to Europa.

NASA Priorities

The activities of the Europa Focus Group address NASA space exploration priorities and support planning for upcoming missions. They also address several of the objectives enumerated in the Astrobiology Roadmap:

- Linking Planetary & Biological Evolution
- Extremes of Life
- Life's Precursors & Habitats in the Outer Solar System
- Effects of Climate & Geology on Habitability

In the end, to get definitive answers to the questions of whether there is life on Europa and what form of life it might be, we will have to land on the ice crust and examine samples directly. In the meantime, the Europa Focus Group is helping to lay the groundwork that will lead to that moment.